REMARKS

Claim 1 has been amended to more particularly define applicant's claimed invention. Basis for the amendment of claim 1 can be found at page 7, lines 18-30 of Applicant's specification. Claim 22 has been added to more particularly define applicant's claimed invention. Basis for the addition of claim 22 can be found at page 15, lines 1-8 of Applicant's specification.

The final rejection of claims 1-6 and 9-11 under 35 U.S.C. 103(a) as being unpatentable over Zurecki et al. (US 5,738,281) in view of Nowotarski et al. (US 5,486,383) is respectfully traversed.

In the Office Action, the Examiner has correctly noted that Zurecki et al. does not "teach using the shrouding gas to spray non-sensitive materials as claimed or increase the standoff distance as claimed". The Examiner has cited Nowotarski et al. in an attempt to make up for the deficiencies in Zurecki et al.

The Examiner notes in the Office Action that Nowotarski et al. "teaches the use of a shrouding gas to minimize oxidation or contamination or degradation of materials being sprayed (column 4, lines 20-25). The Examiner contends that Nowotarski et al. discloses other benefits of using a shrouding gas. However, a closer reading of the portion cited by the Examiner discloses the following:

"The effective entrainment and distribution of the shielding fluid along the length of the turbulent stream minimizes the oxidation or contamination or degradation of materials, such as powder, droplets and/or particles, within the turbulent stream since, reactive gases, such as oxygen , in the turbulent stream's surrounding environment is prevented or substantially prevented from being entrained in the turbulent gas." (underlining added) (column 4, lines 20-27).

It is clear that, when taken in full context, this disclosure of Nowotarski et al. focuses on one overall theme, namely, the purpose of the shielding gas is to prevent reactive gases in the environment from being entrained in the turbulent gas.

The Examiner also notes in the Office Action that Nowotarski et al. "teaches that plastics, ceramics and oxides can be sprayed by this process (column 3, lines 55-65) and these materials would be materials that are not sensitive to oxidation or nitridation". However, as noted above, the overall theme of Nowotarski et al. is that the shielding gas acts to prevent reactive gases in the environment from being entrained in the turbulent gas. Consistent with this overall theme, Nowotarski et al. is more expansive than the Examiner's interpretation in recognizing that the reactive gases in the environment can cause multiple reactions on various materials in which oxidation and nitridation may be two such possible reactions.

The Examiner further notes in the Office Action that Nowotarski et al. "clearly indicates that by reducing the oxygen level that enters the spray stream, standoff distance can be increased". (column 7, lines 35-55). However, a closer reading of the portion cited by the Examiner discloses the following:

"The results illustrates that a longer nozzle standoff distance can be achieved by heating a shielding gas. Heating the shielding gas to 540°F increased the 1% O_2 standoff distance from 2.94 inches to 3.88 inches." (column 7, lines 50-53).

It is clear that, when taken in full context, this disclosure of Nowotarski et al. focuses on heating a shielding gas to obtain a longer nozzle standoff distance. Indeed, the data in Table I (column 7, lines 39-49) shows just the opposite of what the Examiner is asserting. The Table I data shows increasing nozzle standoff (inches) with increasing oxygen levels (0.2%) at both 70°F and 540°F. The oxygen levels are less pronounced at 540°F than at 70°F at identical nozzle standoff distances (inches).

Applicant directs the Examiner's attention to the instant claims which provide a unique method of thermally spraying materials (not sensitive to oxidation or nitridation) by using a gas shield to produce a coating with a desired

microstructure using an extended standoff that is at least 20% longer than the standoff of the thermal spray without a gas shield producing the same microstructure. Applicant's claimed invention is particularly useful for controlling the desired microstructure of a coating (not sensitive to oxidation or nitridation) of components with a complex shape using the shielded thermal spray at an extended standoff. The standoff distance between the surface of the substrate and the exit end of a shielded thermal spray device is at least 20% longer than the standoff distance of a non-shielded thermal spray device and the shielded device producing a microstructure coated layer similar or identical to a microstructure coating that would be produced using the smaller standoff of the non-shielded device.

As discussed below with respect to the cited references, gas shields known in the art are used to prevent or reduce the oxidation of reactive materials such as metals during deposition. It would be thought by those skilled in the art to be nonsensical to use such a shield when spraying a material not sensitive to oxidation or nitridation as claimed by Applicant. Applicant has found, however, that there are additional benefits to be gained using such a shield. Applicant has been discovered that when using such a shield the temperature of the thermal spray effluent is substantially higher close to the thermal spray device and the rate of temperature decline with distance from the device is substantially lower; i.e., the effluent temperature remains high for a longer distance.

Moreover, Applicant has discovered that the temperature effect is sensitive to the flow rate of the shield gas, and that, surprisingly, it does not continuously increase with increasing flow rate, but that there is an optimum flow rate. This effect would not be expected by one skilled in the art. This is illustrated for a particular plasma spray torch using argon shield gas in Example 1 of Applicant's specification.

Surprisingly, Applicant has discovered that by using a gas shield when thermally spraying a high melting material not sensitive to oxidation or nitridation such as ceramic or nonreactive materials such as oxides, but also including nitrides, carbides, and other ceramic and nonreactive materials, that the standoff can be extended without degradation of the microstructure or other properties of the coating. Coatings with a higher density, higher deposition efficiency, higher deposition rate, and more uniform microstructure can be achieved at the extended standoff. These type of coatings would be expected to have greater wear resistance, erosion resistance, higher bond strength, and other desirable properties.

These effects are thought to be due to the increased and extended temperature effect due to the shield on the thermal spray effluent. The efficacy of this discovery is illustrated in Example 2 of Applicant's specification using zirconium oxide. It was shown that the microstructures required for thermal barrier coatings could be obtained at significantly longer standoffs with a shield than without. Moreover, at a given standoff, the microstructures were more uniform, the coatings denser, and the deposition efficiency higher with a shield than without.

The primary reference, Zurecki et al., discloses the use of a shrouding gas to combine with and protect a turbulent gas jet issuing from an orifice to enable control of a gas jet stream composition downstream from the orifice. The natural aspiration rate of the gas jet is used by Zurecki et al. to determine the flowrate of shrouding gas which is introduced around the gas jet in a soft gas cushion which does not disrupt the flow pattern of the gas jet but instead is entrained into the jet stream to the exclusion of ambient gases in the atmosphere. Zurecki et al. uses the shrouding gas to protect the jet spray from reaction with ambient gases, e.g., reduce the amount of oxygen aspirated into the jet spray, and to protect an applied coating from oxidation by entrained air. See, for example, column 3, lines 46-50 and column 4, lines 15-25.

Nowhere does Zurecki et al. disclose or suggest the use of a shrouding gas in thermal spraying a material not sensitive to oxidation or nitridation, or that the standoff distance can be lengthened as provided by Applicant's claimed invention, thereby permitting the application of thermal spray coatings on complex shapes such as turbine blades and vanes, without degradation of the microstructure or other properties of the coating.

The secondary reference, Nowotarski et al., adds nothing to make up for the deficiencies of Zurecki et al. as a primary reference. As noted by the Examiner in the Office Action, Nowotarski et al. discloses the use of a shielding fluid to minimize oxidation, contamination or degradation of coating materials in the turbulent flow stream. See, for example, column 4, lines 20-35.

As with Zurecki et al., nowhere does Nowotarski et al. disclose or suggest the use of a shrouding gas in thermal spraying a material not sensitive to oxidation or nitridation, or that the standoff distance can be lengthened as provided by Applicant's claimed invention, thereby permitting the application of thermal spray coatings on complex shapes such as turbine blades and vanes, without degradation of the microstructure or other properties of the coating.

Applicants submit that alleged obviousness of the instantly claimed invention must be predicated on something more than it would have been obvious to try using a shrouding gas in thermal spraying a material not sensitive to oxidation or nitridation or to try lengthening the standoff distance without degradation of the microstructure or other properties of a coating, to arrive at Applicants' claimed thermal spraying method or the possibility that such a particularly defined method for lengthening the standoff, thereby permitting the application of thermal spray coatings on complex shapes such as turbine blades and vanes, without degradation of the microstructure or other properties of the coating, would have been considered in the future, having been neglected in the past. See Ex parte Argabright et al. 161 USPQ 703. It is submitted that "obvious

to try" is not a valid test of patentability, and patentability determinations based on that as a test are contrary to statute. See In re Mercier 515 F2d 1161, 185 USPQ 774; In re Antonie 559 F2d 618, 195 USPQ 6; In re Goodwin et al. 576 F2d 375, 198 USPQ 1; and In re Tomlinson et al. 363 F2d 928, 150 USPQ 623.

Clearly, it is only by hindsight that the Examiner could impute to the shrouding gas used to protect the jet spray from oxidation of Zurecki et al. and Nowotarski et al., a shield gas used with a jet spray material not sensitive to oxidation or nitridation, to obtain a lengthened standoff distance without degradation of the microstructure or other properties of the coating, and thereby arrive at the instantly claimed method, and such hindsight obviousness after the invention has been made is not the proper test. See In re Carroll 601 F2d 1184, 202 USPQ 571.

In view of the amendment of independent claim 1 and the above arguments, this final rejection is deemed improper and should be withdrawn.

The final rejection of claims 7, 8, 12 and 13 under 35 U.S.C. 103(a) as being unpatentable over Zurecki et al. (US 5,738,281) in view of Nowotarski et al. (US 5,486,383) and further in view of the admitted state of the prior art is respectfully traversed.

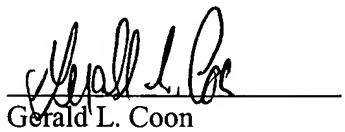
The primary reference Zurecki et al. and secondary reference Nowotarski et al. are discussed above. Both Zurecki et al. and Nowotarski et al. are silent with respect to the use of a shrouding gas in thermal spraying a material not sensitive to oxidation or nitridation, and that the standoff distance can be lengthened as provided by Applicant's claimed invention, thereby permitting the application of thermal spray coatings on complex shapes such as turbine blades and vanes, without degradation of the microstructure or other properties of the coating, as discovered by Applicants.

In view of the amendment of independent claim 1 and the above arguments, this final rejection is deemed improper and should be withdrawn.

It is respectfully submitted that the final rejections of record are improper and that the application is in condition for allowance. Accordingly, reconsideration and allowance of all claims are courteously solicited.

A response to the Office Action mailed May 24, 2005 was due August 24, 2005. Accordingly, submitted herewith is a petition for an extension of time for three (3) months. Please charge fees/surcharge which may be required by this paper, or credit any overpayment, to Deposit Account No. 16-2440.

Respectfully submitted,



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